

I. Statement of Purpose

The purpose of this module is to prepare the nursing assistant to perform the skills necessary to care for the patient with respiratory disorders. The student will learn to recognize and report abnormal respiratory signs and symptoms to the licensed nurse.

II. Terminology

- | | |
|---|---|
| 1. Activity intolerance | 40. Lower respiratory tract |
| 2. Alveoli | 41. Maximum expansion |
| 3. Apnea | 42. Mediastinum |
| 4. Arterial blood gas (ABG) | 43. Mucus |
| 5. Apiration | 44. Nasal cannula |
| 6. Asthma | 45. Nebulizer |
| 7. Atelectasis | 46. Noninvasive |
| 8. Biopsy | 47. Optimal |
| 9. Bronchi | 48. Oropharyngeal |
| 10. Bronchitis | 49. Oxygen saturation |
| 11. Bronchoscopy | 50. Pharynx (throat) |
| 12. Carbon dioxide | 51. Phlegm |
| 13. Chest tube | 52. Pleura |
| 14. Chest X-ray (CXR) | 53. Pneumothorax |
| 15. Cheyne-Stokes | 54. Pulmonary |
| 16. Chronic obstructive pulmonary disease (COPD) | 55. Pulmonary embolus (PE) |
| 17. Continuous positive airway pressure (CPAP mask) | 56. Pulmonary function test (PFT) |
| 18. Culture and sensitivity (C&S) | 57. Pulse oximetry |
| 19. Cyanosis | 58. Respiratory arrest |
| 20. Diaphragm | 59. Respiratory care practitioner (RCP) |
| 21. Dyspnea (shortness of breath) | 60. Shallow breathing |
| 22. Emphysema | 61. Sinuses |
| 23. Endotracheal tube | 62. Splinting |
| 24. Expectorate | 63. Sputum |
| 25. Exertion | 64. Stoma |
| 26. Expiration | 65. Suction |
| 27. Hemoptysis | 66. Tachypnea |
| 28. Humidifier | 67. Thoracentesis |
| 29. Hyperventilation | 68. Tracheostomy (trach) |
| 30. Hypoxia | 69. Trachea |
| 31. Hypoventilation | 70. Tuberculosis (TB) |
| 32. Incentive spirometer (IS) | 71. Turn, cough, deep breathe (TCDB) |
| 33. Inspiration | 72. Upper respiratory tract |
| 34. Intercostals muscles | 73. Ventilation |
| 35. Intubation | 74. Venturi mask |
| 36. Kussmaul's respirations | 75. Vocal cords |
| 37. Labored respirations (respiratory distress) | 76. Weaning |
| 38. Larynx (voice box) | 77. Wheezing |
| 39. Lobes | 78. Yankauer suction |

III. Performance Standards (Objectives)

Upon completion of 4 hours of class plus assignments and 4 hours of clinical experience, the learner will be able to:

1. Define basic terminology.
2. Identify basic anatomy and physiology of the respiratory system.
3. Describe factors that affect our ability to breathe.
4. Describe abnormal signs and symptoms of the respiratory system and the role of the nurse assistant.
5. Recognize common disorders of the respiratory system.
6. Describe patient positioning for maximum lung expansion.
7. Describe how to assist the patient with procedures that improve breathing.
8. Explain the role of the nurse assistant in teaching the respiratory patient.
9. Describe equipment used in the care of the respiratory patient and the related role of the nurse assistant.
10. Identify common tests/procedures performed for determining cause/status of respiratory problems.
11. Describe basic care for patients receiving oxygen therapy.
12. Describe proper procedure for oral suctioning.

IV. References:

1. Chancellor's Office, California Community Colleges (2004). *CNA Model curriculum*. Sacramento: Chancellor's Office, California Community Colleges & CTB/McGraw-Hill.
2. Gerdin, J. (2004) *Health careers today* (3rd ed.) St. Louis: Mosby.
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4. Hegner, B.R., & Caldwell, E. (2003). *Nursing assistant: A nursing process approach* (9th ed.). Albany, NY: Delmar.
5. Sorrentino, S. A. (2004). *Mosby's textbook for nursing assistants* (6th ed.). St. Louis: Mosby Lifeline.

MODULE 11 - RESPIRATORY CARE

Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
Objective 1 Define basic terminology A. Terminology B. Clinical application	A. Lecture/ Discuss B. Use games from previous modules to review terms C. Written test	
Objective 2 Identify basic anatomy and physiology of the respiratory system. A. Purpose and function of upper and lower respiratory tract 1. Upper respiratory tract: a. Nose b. Throat (pharynx) c. Voice box (larynx) d. Wind pipe (trachea) 2. Lower respiratory tract: a. Alveoli b. Intercostal muscles c. Bronchi d. Lungs e. Diaphragm f. Mediastinum g. Pleura B. Lung clearance mechanisms	A. Lecture/discuss B. Use diagrams/ Visuals C. Handout 11.2a - Matching exercise D. Appendix 11.2b - Basic Anatomy and Physiology of the Respiratory System E. Appendix 11.2c - Lung Clearance Mechanisms F. Written test	
Objective 3 Describe factors that affect our ability to breathe. A. Factors that affect the ability to breathe: 1. Age 2. Positioning 3. Elevated temperature 4. Exercise	A. Lecture/ Discuss B. Written test	Provide appropriate nursing care for patients considering the factors that affect their ability to breathe.

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
5. Drugs/medications 6. Obesity 7. Emotions / pain 8. Immobility 9. Smoking		
Objective 4 Describe abnormal signs and symptoms of the respiratory system and the role of the nurse assistant. A. Abnormal signs and symptoms 1. Labored respirations (respiratory distress) 2. Shortness of breath (dyspnea) 3. Noisy respirations (wheezing) 4. Fast/slow respiratory rate 5. Change in ability to perform/tolerate ADLs (activity intolerance) 6. Shallow respirations 7. Dyspnea on exertion (DOE) 8. Hypoxia 9. Sputum a. Increased production b. Change in color of sputum c. Specimen collection (Appendix VIII- 4b) 10. Cyanosis (change in color of skin, especially lips, finger tips and mucous membranes) 11. Hemoptysis B. Role of the nurse assistant 1. Report any signs or symptoms of labored breathing or respiratory distress immediately to licensed nurse. 2. Shortness of breath (SOB) may be a chronic problem for a patient or a new symptom a. If SOB is a new symptom, report immediately to licensed nurse. b. If SOB is a chronic symptom, group care	A. Lecture/ Discuss B. Case studies C. Appendix 11.4a - Hypoxia D. Appendix 11.4b – Sputum Characteristics E. Appendix 11.4c - Specimen Collection F. Written test G. CNA-MC Module 12, objective 2.H, p. 12.7-12.8: Respiratory Distress	Accurately reports all abnormal signs and symptoms immediately to the license nurse. Responds appropriately in an emergency.

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
activities to allow the patient to rest between activities. Use calm, slow movements around patient to help relieve anxiety. Position patient in erect sitting position or leaning forward on over-bed table. 3. Wheezing can signal increasing respiratory difficulty, a build up of fluid in the lungs, or an allergic reaction. If it is a new or worsening symptom, report immediately to licensed nurse. 3. Respiratory rates above or below normal should be reported immediately to licensed nurse. Monitor patient for changes in color of skin (cyanosis), anxiety, confusion, behavioral changes, and fatigue. 4. Changes in respirations or the condition of the lungs can make a patient have difficulty in performing normal ADLs. Even if patient does not have any respiratory difficulty, always monitor patient's ability to perform normal activity and observe for fatigue and SOB; report any changes to licensed nurse. 5. Observe patient not only for number of respirations per minute but the depth of respirations and symmetry. Encourage patient to deep breathe to assist in clearing lung secretions and prevent hypostatic pneumonia. 6. If patient becomes short of breath with activity, allow extra time for ADLs and speak with a slow, calm voice to prevent causing anxiety (if this is a new symptom, report to licensed nurse). 7. Many things can cause inadequate oxygenation - some signs to observe for include: - Pale, cold, clammy skin - Bluish color around lips and finger tips - Report any of these symptoms to the licensed		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
nurse immediately. 8. Hemoptysis is spitting up blood – use Standard Precautions when cleaning up sputum. Report any signs of blood tinged sputum to licensed nurse.		
Objective 5 Recognize common disorders of the respiratory system. A. Common disorders 1. Chronic obstructive pulmonary disease (COPD) 2. Bronchitis 3. Asthma 4. Emphysema 5. Pneumonia 6. Tuberculosis 7. Pulmonary embolism 8. Upper respiratory infection (URI) 9. Sleep apnea B. Review age-related issues. C. Nurse assistant's role in preventing/minimizing respiratory complications D. Resource personnel (i.e., respiratory therapist, licensed nurse)	A. Lecture/ Discuss B. Clinical observation C. Appendix 11.5a - Normal Aging Changes in the Respiratory System D. Appendix 11.5b - Nurse Assistant's Role in Preventing/minimizing Respiratory Complications E. Written test	Recognizes signs and symptoms associated with various respiratory disorders and reports changes to licensed nurse.
Objective 6 Describe patient positioning for maximum lung expansion. A. Patient positioning 1. Pulled up, sitting in bed (semi-high Fowler's) 2. Use of pillows 3. Use of bedside table across bed 4. Sitting at side of bed, leaning on over-bed table B. Maximum lung expansion in elderly	A. Lecture/ Discuss B. Clinical observation C. Skills lab demonstration D. Appendix 11.6- Nursing Care to Minimize the Effects of Aging	Positions patient properly for maximum lung expansion.
Objective 7 Describe how to assist the patient with procedures that	A. Lecture/ Discuss B. Skills lab	Demonstrates proper positioning of patient

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improve breathing. A. Purpose- prevention of atelectasis (a collapsed airless condition of lung alveoli - it is prevented by deep breathing, movement and pain relief) B. Procedures 1. Incentive spirometer 2. Turn, cough, deep breathe (TCDB) 3. Positioning 4. Activity: out of bed, ambulation, splinting, cough blanket, cough pillow 5. Mouth care	C. Clinical observation	for optimum respiration. Correctly assists and encourages patients with procedures that improve breathing.
Objective 8 Explain the role of the nurse assistant in teaching the respiratory patient. A. Reinforce teaching as directed by licensed personnel. 1. Incentive spirometer 2. Turn, cough, deep breathe 3. Positioning 4. Report complaints of pain to licensed nurse (a patient medicated for pain breathes more fully) 5. Activity: out of bed ambulating 6. Splinting/ cough blanket/ cough pillow - Universal/Standard precautions B. Refer to Module 4	A. Lecture/ Discuss B. Written test	Reinforces patient teaching plan in clinical setting as directed by licensed personnel.
Objective 9 Describe equipment uses in the care of the respiratory patient and the related role of the nurse assistant. A. Pulse oximeter – two light sources and a photo detector sense color changes in hemoglobin when placed directly across from each other 1. Probe placement – most common placement on finger, but can be placed on ear lobe, toe, bridge of nose and foot or palm of baby. Do not place over	A. Lecture/ Discuss B. Show samples of equipment C. Skills lab D. Clinical observation	Demonstrates safe, appropriate use of respiratory equipment in clinical setting.

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
fingernail with dark polish or artificial nail. Change sites each day and check for pressure points under the probe. 2. Hospital policy – the licensed nurse or respiratory therapist is responsible for monitoring the pulse oximetry measurements. However, they are very easy to read and you can recognize changes that need to be reported to the licensed nurse. 3. Reporting results (normal and abnormal) – all values should be reported to the nurse. Many facilities rate the value below 92% as abnormal, but be sure to check with your licensed nurse and your facility policy. 4. Trouble shooting for accuracy – patients with poor circulation, dark pigmentation, very low blood count (anemia) will often have inaccurate readings. Vigorous movement by the patient will cause misleading values. B. Chest tube, tubing, canister (DO NOT EMPTY) 1. Check tubing for kinks and prevent patient from laying on it. 2. Patient may be positioned in most positions of comfort – keep off the side where the chest tube is inserted. 3. TCDB every 2 hours is important even with a chest tube in place. 4. Patient may ambulate if ordered by the physician – check with the licensed nurse (make sure the canister remains below the level of the chest). 5. Do not allow the chest tube canister to fall over. 6. The licensed nurse will calculate the output in the chest tube canister. 7. Observe for any of the following signs and report them to the licensed nurse: complaints of pain, shortness of breath, change in vital signs,		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
increased apprehension in the patient, drainage on the dressing at the chest tube insertion site, or a loose chest tube.		
Objective 10 Identify common tests/procedures performed for determining cause/status of respiratory problems. A. Purpose of tests 1. Identify the cause/status of respiratory problems. 2. Give doctor information for proper treatment and/or medication. B. Respiratory tests 1. Pulmonary function test 2. Bronchoscopy 3. Arterial blood gases (ABGs) 4. Chest x-ray 5. Thoracentesis 6. Sputum c & s 7. Pulse oximetry C. Limitations of nurse assistant's role 1. Cannot perform sterile procedures. 2. Act as <i>second pair of hands</i> for the licensed nurse or MD under their direct instruction and supervision. 3. Cannot perform any invasive procedure.	A. Lecture/ Discuss B. Written test	Assists with respiratory tests as directed by the licensed nurse, MD or respiratory therapist, recognizing limitations of nurse assistant's role.
Objective 11 Describe the use of oxygen and equipment for administering oxygen A. Oxygen tank 1. Secured at all times, either chained to the wall, placed in rack or secured into cylinder cart. 2. Can become a deadly missile should a valve be broken off. 3. Close cylinder valves before moving cylinders.	11- 8A. Lecture/ Discuss B. Clinical observation C. Appendix 11.11 – Oxygen Equipment D. Written test	Provides appropriate and safe care to the patient receiving oxygen therapy.

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
4. Do not store near electrical circuit. 5. Do not open cylinder valves with wrenches or pliers. 6. Always open the valve before turning on the flowmeter. 7. Always close the valve and turn on the flowmeter to release the pressure in the regulator. 8. Oxygen supports combustion – materials that are combustible and flammable in air will ignite more easily and will burn more vigorously in an oxygen-rich atmosphere. 9. Materials that are not normally considered to be combustible in air may be considered combustible in an oxygen-enriched atmosphere. 10. Some combustible materials that may be found near a patient receiving oxygen – oils, Vaseline, skin lotions, facial tissue, clothing, bed linen, rubber and plastic articles, suction and oxygen tubing, alcohol and acetone. 11. Anything that can spark can create a fire around oxygen – i.e. smoking, electrical heaters, defibrillator, defective electrical equipment. B. Nasal cannula – simple two-pronged plastic device that is used to deliver low concentrations of oxygen and allows the patient to eat and talk normally. 8. Place a nasal prong into each nare of the nose and adjust straps of the oxygen tubing over the ears and under the chin. 9. Some patients like to have gauze padding wrapped around the tubing that goes over the ears. 10. Check cannula regularly for clogging or crusting. 11. Clean only with a damp rag – do not use alcohol or soap and water. Change cannula if clogged or badly soiled. 12. Observe nares of nose and ears for sores and		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
report immediately to licensed nurse. C. Oxygen Masks 1. Types: a. Simple – used for low to moderate oxygen concentrations – should not press too tightly on the face as this may cause a feeling of claustrophobia. b. Non-rebreathing – used for higher concentrations of oxygen but cannot be used for controlled oxygen concentrations and must be adjusted for proper fit. Bags on partial and non-rebreather masks must remain inflated during both inspiration and expiration – this is accomplished by adjusting the flow so the bag does not collapse on inspiration (check with your respiratory therapist when transporting patients and changing from wall oxygen to portable oxygen). c. Venturi mask or Venti mask - allows delivery of precise oxygen flow. A constant flow of room air is blended with a fixed flow of oxygen to provide diluted oxygen and precise low amounts to the patient. 2. Care Guidelines a. Adjustable elastic bands are provided that fit over the head to secure the mask and must be checked frequently for pressure areas. b. Face masks need to fit securely and skin under mask must be checked frequently for irritation. c. Mask must be removed so that the patient may eat, drink and take medications. d. May reapply nasal cannula and mask when O₂ already turned on and set at proper liter flow by licensed nurse or respiratory therapist. e. If oxygen ordered PRN, may reapply after		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
patient returns from activity (bathroom, eating, ambulating, etc.) . f. If oxygen ordered continuously, reapply when mask/cannula slips off face. D. Tracheostomy - Definition - A surgically created opening through the neck into the trachea. The protective upper airway is bypassed causing greater risk for infection. - It also allows water to flow directly into the lungs if accidentally spilled over the trach area (when bathing patient or when patient is drinking). - Care guidelines - The nurse assistant never changes the ties or inner cannula. - Some facilities may allow the nurse assistant to suction secretions external to the cannula and cleanse the outer stoma – refer to facility policy. E. Ambu bag to face mask - Ventilating bag attached to a mask that can deliver oxygen. - It gives a good seal and provides a barrier for Standard Precautions. - It is used in emergencies as part of CPR. Check facility policy for nurse assistant's role in using ambu bag and training before it is used. F. Incentive spirometer (IS) - Promotes full expansion of the lungs and prevents pulmonary complications (i.e. atelectasis and pneumonia). - The patient exhales through the nose and then inhales through the mouthpiece on the incentive spirometer (IS) .		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
3. Use of the IS is based on the learning theory that immediate objective feedback increases motivation to learn and results in quicker learning. 4. IS is quite effective and most patients do more deep breathing using them. G. Flow meter 1. A device that attaches to the oxygen outlet to adjust the amount of oxygen being delivered. 2. They register the amount of oxygen being delivered in liters per minute. 3. Two types – mercury, ball and gauge. H. Humidifier 1. Container of sterile water, usually pre-filled, that is attached to the oxygen delivery equipment 2. Liquefies lung secretions to keep them loose and facilitate expectoration. 3. Oxygen flows through the water and picks up moisture. 4. Water must be sterile to prevent infections. 5. Changed when the water level is low or according to facility policy (many facilities change the humidifier every 24 hours). 6. Some facilities are only using humidifiers for oxygen delivery of over 2 liters. I. Resource personnel- respiratory therapist, licensed nurse. J. Safety issues (included under each piece of equipment – repeat important issues here). 1. Oxygen not explosive, but supports combustion. 2. No smoking around any oxygen delivery system. 3. Inspect all electrical equipment for defective plugs or frayed cords that could cause a spark. 4. The patient cannot use any electrical equipment around oxygen (radios, electric razors). 5. Avoid wool blankets as they cause static electricity.		

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
6. Avoid use of Vaseline as it is a petroleum product and is combustible.		
Objective 12 Describe basic care for patients receiving oxygen therapy. A. Feeding patient on oxygen therapy 1. Allow time to breathe between bites. 2. Check for orders to remove oxygen for meals. 3. Keep food off tubing. 4. Cleaning nasal cannula a. Wipe with damp cloth only. b. Do not use alcohol or soap and water. 5. Nasal cannula prongs and mask positioned properly 6. Secured straps 7. Check ears for irritation under tubing. 8. No kinks in tubing 9. Differences in types of oxygen masks B. Nurse assistant's role 1. May <u>not initiate</u> oxygen therapy 2. Changing oxygen tanks 3. Changing to portable oxygen when transporting patient C. Safety measures 1. No smoking around oxygen 2. All electrical equipment must be grounded 3. Observe for signs and symptoms or respiratory distress (See objective 4, this unit).	A. Lecture/ Discuss B. Clinical observation C. Appendix 11.11: Oxygen Equipment D. Written test	Provides appropriate and safe care to the patient receiving oxygen therapy.
Objective 13 Describe proper procedure for oral suctioning. A. Purpose and procedure B. Role of the nurse assistant 1. Nurse assistant cannot suction airways.	A. Lecture/ Discuss B. Lab practice C. Demonstrate use of Yankauer suction D. Clinical observation E. Written test	Demonstrates safe oral suctioning of a patient.

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Content Outline Theory Objectives	Suggested Learning Activities/Evaluation	Clinical Activities
2. Suctioning is limited to oral cavity ONLY. 3. Nurse assistant can use suction to prevent aspiration of fluids used in performing oral care. 4. Each health care facility may have different guidelines regarding restrictions for nurse assistants in suctioning procedure (refer to nurse assistant's job description and facility policy and procedures).		

SAMPLE TEST QUESTIONS

Directions: Circle the best answer

1. Abnormal respiratory signs and symptoms include:
 - a. Labored respirations at a rate of 32 breaths per minute
 - b. Wheezing
 - c. Intolerance to activity
 - d. All of the above
2. When caring for a patient receiving oxygen, the nurse assistant may:
 - a. Change the amount of oxygen the patient is receiving.
 - b. Reapply nasal cannula when patient returns from bathroom, if oxygen is already turned on.
 - c. Start oxygen therapy on newly admitted patient.
 - d. Change from mask to nasal cannula per patient's request.
3. When performing pulse oximeter testing, the nurse assistant should:
 - a. Report all results to the licensed nurse.
 - b. Report only abnormal oxygen saturation.
 - c. Determine when this test should be done.
 - d. Perform test with oxygen in place or as directed by licensed nurse.
4. Interventions that help prevent atelectasis include:
 - a. Use of an incentive spirometer as ordered.
 - b. Turn, cough and deep breathe.
 - c. Ambulate as ordered.
 - d. All of the above.
5. Patients with COPD breathe easier when lying flat in bed with one pillow.
 - a. True
 - b. False
6. The purpose of a nebulizer is to
 - a. Help the lungs expand fully.
 - b. Helps prevent pneumonia.
 - c. Delivers pressure to the airway to keep it open.
 - d. Deliver moisture or medication deep into the lungs.
7. The patient who has a chest tube
 - a. Cannot get out of bed if it is connected to a vacuum regulator.
 - b. Needs to have oxygen until ambulatory.
 - c. Needs to have a tray of emergency equipment kept in the room.
 - d. Needs to have the drainage measured and emptied every shift.
8. You have a patient who has a tracheostomy. Your care includes:
 - a. Suctioning the outer part of the tube if becomes clogged with mucus.
 - b. Checking to see if the cuff is inflated before feeding the patient.
 - c. Changing the ties if they are loose or soiled.
 - d. Keeping the patient in a semi-fowler position to promote drainage.

SAMPLE TEST QUESTIONS - KEY

1. Abnormal respiratory signs and symptoms include:
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 - c. Intolerance to activity
 - d. **All of the above**
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 - d. Keeping the patient in a semi-fowler position to promote drainage.

MATCHING EXERCISE

Directions: Match the definition on the right to the term on the left.

- | | |
|-------------------------|---|
| ____ 1. Respiration | a. Disease- causing organism |
| ____ 2. Eliminate | b. Process of breathing in air during respiration |
| ____ 3. Expiration | c. Cessation of breathing |
| ____ 4. Pathogens | d. To do away with or get rid of |
| ____ 5. Apnea | e. Anything that contaminates the air |
| ____ 6. Inhalation | f. Process of breathing out air during respiration |
| ____ 7. Cyanosis | g. Exchange of oxygen and carbon dioxide between the atmosphere and the cells of the body |
| ____ 8. Dyspnea | h. Element in the atmosphere necessary for maintaining life |
| ____ 9. Oxygen | i. Waste product of the cell |
| ____ 10. Carbon dioxide | j. Difficulty swallowing |
| ____ 11. Pollutants | k. Bluish discoloration of the skin caused by a lack of adequate oxygen |
| ____ 12. Dysphagia | l. Difficult or labored breathing |

MATCHING EXERCISE - KEY

<u> G </u> 1. Respiration	a. Disease- causing organism
<u> D </u> 2. Eliminate	b. Process of breathing in air during respiration
<u> F </u> 3. Expiration	c. Cessation of breathing
<u> A </u> 4. Pathogens	d. To do away with or get rid of
<u> C </u> 5. Apnea	e. Anything that contaminates the air
<u> B </u> 6. Inhalation	f. Process of breathing out air during respiration
<u> K </u> 7. Cyanosis	g. Exchange of oxygen and carbon dioxide between the atmosphere and the cells of the body
<u> L </u> 8. Dyspnea	h. Element in the atmosphere necessary for maintaining life
<u> H </u> 9. Oxygen	i. Waste product of the cell
<u> I </u> 10. Carbon dioxide	j. Difficulty swallowing
<u> E </u> 11. Pollutants	k. Bluish discoloration of the skin caused by a lack of adequate oxygen
<u> J </u> 12. Dysphagia	l. Difficult or labored breathing

BASIC ANATOMY AND PHYSIOLOGY OF THE RESPIRATORY SYSTEM

Normal Anatomy and Physiology of the Respiratory System.

For the millions of cells throughout the body to carry out their specialized activities, they must have a continuous supply of oxygen. The respiratory system works with the cardiovascular system to deliver the oxygen to the cells, where it is used to provide the cells with energy to carry out metabolism.

External respiration, or breathing, allows this exchange of oxygen and carbon dioxide between the lungs and the environment. As air is inhaled, it is warmed, moistened and filtered to prepare it for use by the body.

Internal respiration refers to the exchange of oxygen and carbon dioxide at the cellular level. Oxygen enters the cells while carbon dioxide leaves the cell. These gases diffuse (move, spread) across the cell membranes into the bloodstream. The cardiovascular system plays the role of transporter. Failure of the respiratory or cardiovascular systems has the same result: rapid death of the cells from oxygen starvation.

Upper Respiratory Tract

Nose - Air enters the respiratory tract through the nose. The air is filtered, moistened, and warmed as it enters. The nasal septum separates the nares. This entire area is lined with mucous membranes, which are filled with blood vessels. This provides the warmth and moisture necessary. Normally a liter of moisture is secreted by these membranes every day. This is the area that causes problems with sinus infection or colds. The patient is unable to warm or moisten the inspired air.

To the sides of the nasal cavities are the three scroll-like bones called turbinates or conchae. These cause the air to move over a larger surface area. This increase in surface area allows the air more time for warming and moisturizing. Lining the nasal cavities are tiny hairs, which trap dust and other foreign particles and prevent them from entering the lower respiratory tract.

The sinuses are hollow areas which make the skull lighter. It is believed they give resonance to the voice. They also are lined with mucous membranes that are continuous with the nasal cavity. Because of this, nasal infections can cause sinusitis, which is uncomfortable and difficult to treat. The receptor for the sense of smell is located in the mucous membranes of the nasal cavities. The tear ducts have openings to the upper nasal chamber so when a person cries, nasal secretions are increased.

Pharynx - Another name for the throat. It is approximately 5 inches long and is the passageway for both air and food. At the end of the pharynx, food passes to the esophagus. The pharynx is divided into three subdivisions: 1) nasopharynx (upper portion); 2) oropharynx (just behind the mouth); and 3) laryngopharynx (directly above the larynx). The eustachian tubes enter both sides of the nasopharynx, connecting to the middle ear. Because the inner linings of the pharynx and the eustachian tubes are continuous, an infection of the pharynx can spread easily to the middle ear. This is very common in children.

Larynx - The larynx, or voice box, connects the pharynx with the trachea. The epiglottis, a large, leaf-shaped area of cartilage, protects the larynx when swallowing. It covers the larynx tightly to prevent food entering the trachea and directs the food to the esophagus. The larynx contains the vocal cords.

Trachea - The trachea, or windpipe, is a tube-like structure that extends approximately 5 inches to the mid-chest, where it divides into the right and left bronchi. It lies in front of the esophagus and connects the larynx with the bronchi. It contains C-shaped rings of cartilage that keep it from collapsing. The open part of the C-shape lies to the back of the tracheal column and in front of the esophagus. This allows for expansion of the esophagus during swallowing while still keeping the trachea open for uninterrupted breathing. The whole structure is lined with mucous membranes with tiny cilia that sweep dust or debris upward toward the nasal cavity. Any large particles in this area trigger the cough reflex, which is a protective mechanism that aids in the removal of foreign material. If a tracheostomy (a surgical opening into the trachea) must be performed, the individual breathes through the tracheal opening rather than the nose. The opening is below the larynx, so the air cannot pass over the vocal cords. The vocal cords cannot vibrate, and speech becomes physiologically impossible. The air also does not pass through the upper airways to be moistened which creates drying of secretions and mucus forms plugs that block the airways. A patient with a tracheostomy must constantly be aware of moisturizing the air and clearing the airway.

Lower Respiratory Tract

Bronchial Tree - As the trachea enters the lungs, it divides into the right and left bronchi. The right bronchus enters into the right lung. It is larger in diameter and more vertical in descent. The left bronchus enters the left lung. It is smaller in diameter and slightly horizontal in position. Because of this design, foreign objects that are aspirated often enter the right bronchus.

Bronchioles - The large bronchi continue to divide into smaller structures called bronchioles. It has been estimated that there are more than a million bronchioles in each lung, each about 1 mm in diameter. These structures continue to divide into smaller, tube-like structures called terminal bronchioles or alveolar ducts. This branching and continual division of tubules make these structures resemble a tree with its branches - hence the name bronchial tree. All of these structures are lined with a ciliated mucous membrane as is the trachea.

Alveoli - The sac-like structures at the end of the bronchial tree resemble a bunch of grapes. A single grape-like structure is called an alveolus. It is in this terminal structure of the bronchial tree that gas exchange takes place. Each alveolus is surrounded by a blood capillary. Carbon dioxide and oxygen are exchanged across the alveolar capillary membrane. Each alveolus is composed of hundreds to thousands of alveoli contained in alveolar sacs. The walls of the individual alveoli are composed of a single layer of cells with elastic fibers intertwined. This enables them to contract and relax with breathing. In addition, each alveolus is coated with a thin covering of surfactant. This is a lipoprotein that reduces the surface tension of the alveolus and prevents it from collapsing and sticking together between each breath. There are millions of alveoli in the lungs; they give shape and form to the lungs. They are filled with air, and lung tissue would float if submerged in water. This tiny grape-like structure is the most important feature of the respiratory system.

Capillaries - In the cardiovascular system the vessels get smaller and smaller until they reach the smallest structure called a capillary, which is microscopic. In the lungs these capillaries surround the alveoli. Because the walls of the capillaries are thin and the walls of the alveoli are also thin, diffusion allows the oxygen to pass from the alveoli into the capillaries in exchange for carbon dioxide. Once the oxygen enters the capillaries, it attaches itself to the red blood cells, more specifically, the hemoglobin portion of the red blood cells. The oxygen then continues in the bloodstream to the heart to be transported to the cells throughout the body.

LUNG CLEARANCE MECHANISMS

Inhaled air always contains small pieces of matter and microorganisms. These substances do not usually create problems because the lungs have an excellent set of mechanisms for clearing unwanted material.

Filtration in the Nose

The nose contains hairs that serve to filter out large dust particles. The effectiveness of the filtering mechanism becomes apparent when a lot of dust is in the air.

Mucus Production

Mucus is secreted by glands in the membranes throughout the respiratory system. Small particles are trapped in the mucus. Mucus both protects the tissue from the particle and provides a medium for removal.

Ciliary Clearance

Tiny cilia throughout the bronchial tree are continuously active in moving mucus toward the upper airway. Smoke paralyzes cilia in the lungs, making lung clearance more difficult. Cilia may also be damaged by disease processes.

Macrophages

There are no cilia in the alveoli. Instead, macrophages surround particles to remove and destroy them. The particles are disposed of through the lymphatic system. The mucus then moves to an area where cough may effectively remove it.

Position Changes

When the position of the body is changed, mucus (with its small pieces of matter) moves in the lung as a result of gravity. Because of the branching nature of the lungs, almost any position will cause some lung segments to drain. As the position is changed, different segments are able to drain.

Cough

Coughing is a mechanism to protect the lungs from aspiration of foreign material in the upper airway and to clear material from the lower airway. For the most productive cough to occur, there is deep inspiration, the glottis is closed, expiratory muscles contract forcefully building up pressure in the chest, then the glottis is opened, expelling material from the airway. Cough may be caused by stimulation of receptors in the upper airway (trachea and pharynx) or those in the lower airway (larynx and bronchi). Irritant gasses (such as smoke), fluids, touch, and particles in the air may all stimulate these receptors.

The *huff* cough is like a regular cough except that it is done with the glottis open. High pressures are not achieved in the chest, but it appears that this type of cough facilitates peripheral airway clearance.

The *quad* cough was developed for the use of quadriplegic patients (those paralyzed in all four extremities). The quad cough is used to assist an individual with weak or ineffective muscle action. When the person coughs, the nurse applies pressure with the hand on the abdomen with an upward and inward motion, thus increasing the pressure for expulsion of secretions.

SIGNS AND SYMPTOMS OF HYPOXIA

- Apprehension, anxiety, restlessness
- Decreased ability to concentrate
- Decreased level of consciousness
- Increased fatigue
- Vertigo
- Behavioral changes
- Increased pulse rate (bradycardia with advancing hypoxia)
- Increased rate and depth of respiration (as hypoxia progresses, shallow, slow respirations develop)
- Elevated blood pressure (if hypoxia is not corrected, blood pressure will decrease)
- Cardiac dysrhythmias
- Pallor
- Cyanosis
- Clubbing
- Dyspnea

RANGE OF SPUTUM CHARACTERISTICS

COLOR:

Clear
White
Yellow
Green
Brown
Red
Streaked with blood

ODOR:

None
Foul odor

BLOOD:

All the time
Occasionally
Early morning

CONSISTENCY:

Frothy
Watery
Tenacious

SPUTUM COLLECTION

1. Follow general procedures for testing
2. Gather equipment (clean container and lid)
3. Wash hands and don gloves
4. Have patient rinse mouth (do not use mouth wash)
5. Assist patient to expectorate
 - sitting position
 - splint incision if necessary
 - may need to obtain during respiratory treatment
6. Label specimen and send to lab ASAP
7. Comfort measures
 - mouth care
 - possible nausea
8. Remove gloves and wash hands

SPECIMEN COLLECTION

General Procedure

A. Nursing Preparation

1. Know which test is needed, assemble correct equipment, review procedure.
2. Identify patient to be sure procedure is for right patient.
3. Consent form if necessary (responsibility of RN)
4. Obtain help, if necessary (assisting heavy patient to BSC, lifting equipment).
5. Determine if any special equipment needed (wheel chair to assist to bathroom, water-proof bed pads, etc).

B. Preparing The Patient For Tests

1. Communication skills
2. Clear instructions as to right time, need for test, what patient must do.
3. Obtain the patient's cooperation to participate in the test (Remain NPO if necessary, call next time need to void, drink extra water, etc.).
4. Answer patient's questions about the test or refer to licensed nurse as needed.
5. The more informed the patient, the more cooperative she/he will be.

C. Perform The Procedure

1. Use aseptic technique (wash hands).
2. Gather equipment.
3. Prepare the environment (privacy, draping, assist with positioning).
4. Obtain the:
 - right amount of specimen
 - in the right container
 - at the right time
 - from the right patient.
5. Wear gloves if contact with body fluids (follow Standard Precautions and Category Specific Isolation procedures.)
6. Reestablish comfort (reposition patient, straighten bedding, notify nurse of need for pain medication, etc).

D. Delivery And Documentation

1. Handle and label specimen correctly (may need to be refrigerated or delivered immediately to lab)
2. Document procedure correctly or report to nurse that specimen obtained.

NORMAL AGING CHANGES IN THE RESPIRATORY SYSTEM

Lungs comprise the organ of the body that, in addition to the skin, is most exposed to the environment. Smoke, bacteria and multiple irritants are inhaled daily for many years. The elderly frequently have other diseases that may affect lung function. For these reasons it is very difficult to differentiate the effects of environment and disease from the effects of aging. Although the function of the pulmonary system decreases with age, the loss involves the reserve necessary during stress. The losses are not great enough to interfere with ordinary activity. And even this decrease in reserve can be kept to a minimum if elderly people actively maintain fitness.

Anatomical Changes with Aging

1. Skeletal deformities of aging, such as a kyphosis, cause the thorax to become shorter and the anterior posterior (front to back) diameter to increase. This results in less space for the lungs to expand and decreased lung volume.
2. Osteoporosis of the ribs and vertebrae and calcification of the costal cartilage contribute to chest wall stiffness. This stiffness produces a decline in the ability of the chest wall to expand and contract normally with each breath.
3. Chest wall muscles, (diaphragm, intercostal muscles and accessory muscles) like other muscles in the body, weaken with age. This combination of increased stiffness of the chest wall and diminished muscular strength reduces the efficiency of breathing, so that the aged have reduced maximal inspiratory and expiratory force. More muscle work is needed to move air in and out of the lung.
4. Within the lung structures themselves other significant changes are taking place. At age 20, a person has about 300 million alveoli, which provide an exchange surface of 80 square meters, about the size of a tennis court. The number of alveoli remains constant in the healthy aging person, but there are changes in the alveoli. The alveoli enlarge, the walls become thinner and there are fewer capillaries present. This loss of alveolar structure gives aged lungs some of the microscopic characteristics of emphysematous lungs and is sometimes called "senile lung." Thus the effective alveolar surface area that is vital to gas exchange is reduced to 65 to 70 square meters by age 70.
5. Because of the following changes, the elderly are less able to provide adequate force to move air rapidly:
 - Decreased lung volume
 - Chest wall stiffness
 - Weaker chest wall muscles
 - Loss of elasticity of lungs
 - Reduced alveolar surface area for gas exchange

The work of breathing is increased so the elderly tend to make greater use of all respiratory muscles, especially the diaphragm. This increased reliance on the diaphragm makes the elderly more sensitive to changes in pressure within the abdomen, such as after a large meal or the body position of bending over to tie shoes.

Functional Changes

1. Functional changes refer to changes in the volume of air moved as occur with aging. Although total lung volume remains fairly constant, age influences the different measurements of this volume. The following is a list of pulmonary function tests (PFTs) that are done to measure lung volumes.
 - a. **Tidal volume** - One of the most significant lung volumes for nursing care is the amount of air moved with a normal breath (tidal volume).
 - b. **Dead space** - the portion of air that moves from the mouth through the terminal bronchioles. It is not in contact with the alveoli and therefore does not participate in gas exchange. The amount of dead space in the lung is approximately equal to an individual's weight in pounds. Thus, if a person weighs 200 pounds, about 200 cc of the tidal volume is dead space ventilation. Tidal volume, which can be very simply measured with a spirometer, should be relatively unchanged in the aged.
 - c. **Minute ventilation** - the amount of air that is moved in 1 minute. It is determined by multiplying the tidal volume by the number of respirations in 1 minute. There are conflicting reports on changes in respiratory rate with age in adults, but it appears that there is little if any significant effect from aging in normal subjects at rest.
 - d. **Residual volume** - the volume of air that remains in the lung after a maximal expiration. It increases with age, probably because of the loss of elastic forces in the lung. This increased residual volume encroaches on and reduces the vital capacity.
 - e. **Vital capacity** - maximum amount of air that can be breathed out after breathing in as much as possible. Studies have shown that vital capacity decreases 25 percent in the aged while residual volume increases about 50 percent. The reduction in vital capacity is thought to be largely related to the loss of chest wall mobility.
2. **Air flow rates** - the rate at which air is moved in and out of the lungs is reduced in the elderly. The amount of air an individual can breathe in and out, as rapidly as possible, in a given period of time declines by 50 percent from the third to the ninth decades. Even in a healthy aged person, the lungs have some of the features of chronic obstructive lung disease.
3. **Decrease in air flow** and trapping of air in lungs. There is a collapse of the airways on expiration with trapping of gas in the lungs and a decrease in flow of air. The small airways are less stable, especially when smaller breaths are taken, as happens with the elderly. This early airway closure increases with age and with shallow breathing. It may also be increased in the supine position. A practical application in nursing care of this knowledge of airway closure is a reinforcement of the need to encourage deep breathing in the elderly and to keep them out of bed as much as possible.
4. **Gas exchange changes** in the elderly. As mentioned earlier, the alveoli enlarge, the walls become thinner, and there are fewer capillaries present, making less surface for gas exchange. There is also an age-related reduction in the amount of hemoglobin, which is necessary to carry oxygen.

5. **Diminished response to low oxygen levels** - There is a decreased response to hypoxia (low blood levels of oxygen) and hypercarbia (high levels of CO₂). This has great clinical significance for nurses and nursing assistants. The usual clinical signs of increased need for oxygen include increases in breathing rate and volume, and increased heart rate and blood pressure. These responses are all slower and blunted in the elderly. Therefore, additional cues, such as changes in mentation (decreased ability to concentrate, confusion) and affect (behavior such as anxiety, sadness, fear and irritation), must be used to detect and prevent complications from lack of oxygen or high CO₂ levels.
6. **Protective function of the lung decreases with age**
 - The **cough mechanism** is impaired in the elderly, which may be due to weakened respiratory muscles.
 - Less effective **ciliary action** and **fewer cilia** (which clean the lungs) leads to decreased ability to clean and protect the lung.
 - **A decrease in IgA**. This is a protein of the immune system that protects the nasal and respiratory mucosal surfaces from harmful bacteria and viruses.
 - The fourth factor is the **defective activity of alveolar macrophages** (phagocytic cells that ingest foreign material). They are present in the alveoli and decrease with age. This factor affects smokers especially.

**NURSE ASSISTANT'S ROLE IN PREVENTING OR
MINIMIZING RESPIRATORY COMPLICATIONS**

Encourage coughing and deep breathing

Reinforce the use of the incentive spirometer

Hydration and nutrition - offer fluids every two hours as allowed to keep lung secretions thinned

Assist with activity and early ambulation

Positioning - change position and turn bedridden patients at least every two hours

Identify and report signs and symptoms of oxygen deficiency or malfunction of oxygen delivery equipment

Identify and report signs and symptoms of infection - use good observational skills

Identify and report signs and symptoms of pain and institute comfort measures

Measure and record intake and output accurately

Encourage self-care

Reinforce patient/family teaching

NURSING CARE TO MINIMIZE EFFECTS OF AGING

1. Position for **maximum lung expansion**:
 - Patients must be kept pulled up in bed. When a patient slides down in bed, the chest wall becomes compressed and lungs cannot expand fully.
 - For patients sitting up in a Fowler's position, placing pillows under the arms to support the extremities allows for greater lung expansion.
 - In a side-lying position, placing the upper arm on a pillow along the patient's back allows for better chest wall expansion than curling both arms around a pillow to the chest.
 - Patients in wheelchairs and geri-chairs must be kept pulled up to prevent collapse of the upper chest. Placing pillows to support the upper trunk will help maintain maximum lung expansion.
 - Some patients with respiratory disease prefer to sit at the bedside or in a chair and lean on an over-bed table. Make sure the wheels are locked on the bed or wheelchair and place a pillow on the table for the patient to rest the arms and head. This allows for better expansion of the chest wall.
2. Normal breathing must be promoted. Encourage the patient to take deep breaths frequently and to stand up as straight as possible when walking. If a patient is in bed most of the day, turning, repositioning and deep breathing will help mobilize secretions in the lung.
3. Heavy bed linens can compromise the normal expansion of the chest in a patient who is weak and has other complications of illness or aging. Keep heavy bed linens off the chest. Some patients will cover themselves with favorite afghans and multiple blankets. Use warm, light-weight linen like thermal blankets provided in most facilities instead of multiple layers of sheet, blankets and bedspread.
4. Keep the patient as active as possible. It is common knowledge that there is a decrease in exercise tolerance in the elderly. They have an increased heart and respiratory rate with minimal exercise. Studies are being done that indicate that aged athletes who participate in endurance training can lower their heart rates and breathlessness created by exertion. This shows that even though we cannot modify age, we can modify fitness by exercise and activity. In the elderly it is even more important not to aggravate physical limitations by inactivity.

OXYGEN EQUIPMENT:

1. Incentive spirometer
2. Oxygen setup
 - O₂ tank
 - Flow meter
 - Humidifier
 - Nasal cannula
 - Face mask (various types)
3. Chest tube, tubing, canister
4. Pulse oximeter

CRITERIA:

1. Demonstrate patient positioning for maximum lung expansion.
2. Demonstrate how to assist the patient with the following:
 - Incentive spirometer
 - Turn, cough, deep breathe
 - Positioning
 - Coughing with splinting, cough blanket, cough pillow
 - Mouth care
3. Demonstrate the use and care of the following equipment:
 - Incentive spirometer
 - Changing O₂ tank
 - Flow meter
 - Humidifier
 - Nasal cannula
 - Face mask (simple, Venti, non-rebreather),
 - Chest tube, tubing, canister (DO NOT EMPTY, DO NOT CLAMP)
 - Pulse oximeter